CLAIMS

WE CLAIM

1. A pump device for gaseous fluid, comprising an ion generating region having an electron-emitting cathode electrode for generating unipolar ions in the fluid and a pumping region disposed downstream of the ion generating region, said pumping region including pumping electrodes for generating an electric field in a manner that imparts motion to the ions and thus to the fluid.

2. The pump device of claim 1 wherein the electron-emitting cathode electrode emits electrons at room temperature in atmospheric air.

3. The pump device of claim 1 including an anode to which a positive voltage bias is applied to cause the cathode electrode to emit electrons into the fluid.

4. The pump device of claim 1 wherein the electron-emitting cathode electrode includes a conical tip.

5. The pump device of claim 1 wherein the pumping region comprises a series of pumping electrode sets whose polarity is switched in a manner to generate an electric field that imparts motion to the unipolar ions and thus the fluid in the direction.

6. Combination of a heat generating electronic component and a cooling system in thermal transfer relation with the heat-generating component to remove heat therefrom using a gaseous heat transfer fluid, said cooling system including a plurality of pump devices of claim 1 to impart motion to the heat transfer fluid relative to the heat-generating component.

7. The combination of claim 6 wherein the pumping electrodes reside on one or more heat transfer surfaces.

8. The combination of claim 7 wherein the one or more heat transfer surfaces comprise one or more surfaces of the component or a heat sink in heat transfer relation with the component.

9. A method of generating a flow of a gaseous fluid, comprising emitting electrons from an electron-emitting cathode electrode into a gaseous fluid to generate unipolar ions in the fluid and establishing an electric field that imparts motion to the ions and thus the fluid.

10. A method of removing heat from a heat-generating electronic component, comprising emitting electrons from an electron-emitting cathode electrode into a gaseous heat transfer fluid to generate unipolar ions in the heat transfer fluid and establishing an electric field that imparts motion to the ions and thus the heat transfer fluid relative to the component to remove heat therefrom.

11. The method of claim 10 wherein the electrons are emitted at room temperature in atmospheric air.

12. The method of claim 11 wherein the electrons are emitted from a conical tip of the electron-emitting cathode electrode.

13. The method of claim 10 wherein the electrons are emitted as a fountain-like electron stream.

14. The method of claim 10 wherein the heat transfer fluid is air.

15. The method of claim 10 wherein a translating electric field is generated downstream of the cathode electrode by switching polarity of a series of pumping electrode pairs to impart motion to the ions and thus the heat transfer fluid relative to the component.

16. The method of claim 10 including disposing the pumping electrodes on a heat transfer surface of the component or of a heat sink in thermal transfer relation with the component.

17. An ion generator, comprising an anode electrode and a cathode electrode for emitting electrons into a gaseous fluid in a manner to generate unipolar ions in the gaseous fluid when a voltage is applied between the anode electrode and the cathode electrode.

18. The ion generator of claim 17 wherein the anode electrode and the cathode electrode are disposed in air to generate unipolar ions therein.

19. A gaseous fluid pump, comprising a series of pumping electrodes disposed along a fluid flow path for generating an electric field in a manner that imparts motion to unipolar ions present in the gaseous fluid and thus to the fluid in the direction of the flow path.

20. The pump of claim 19 wherein the electric field imparts motion to unipolar ions present in air.